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A
DESCRIPTION
OF A
PULVERIZING MILL,
Lately invented for the USE of
APOTHECARIES,
TO
Supply the Place of the *Pestle* and
Mortar.

By STEPHEN HEMSTED, Surgeon,
of HAVERHILL, SUFFOLK.

✓

Ego pro te molam. TER.

L O N D O N:

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P R E F A C E.

THE great inconvenience and imperfection of the method commonly used to pulverize the hard bodies used in medicine, with the pestle and mortar, have been long felt and acknowledged by the practisers of physic; and these inconveniences are two-fold, the one arising from the great expence of time and labour necessary to render them in any degree fit for use, the other from the impossibility, by this method, of making compounds perfect; that is, when different ingredients are to be united, of securing the just proportion of

A each

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each of them required in the medicine : The first of these is too obvious to need any proof ; but with respect to the latter, it may be necessary to enlarge a little. Some bodies, from the structure of their parts, are more easy to pound and divide than others ; and as the greater the interstices of any matter are, the sooner it will be separated, and the lighter it will be ; so, consequently, those particles which are more rare and light will, by the force of percussion in pounding, be soonest put in motion ; and being, perhaps, springy, will rise highest, and be lost over the sides of the mortar, before

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before the matter less rare can be properly reduced; thus the compound will not be according to receipt. If we mean to try the natural power of a medicine, surely it is a matter of the first importance, that the medicine be not only genuine, but truly and accurately prepared. The physician prescribes, but often-times his prescription has not the desired effect, owing sometimes to the inequality of the preparation, and sometimes to the sophistication of drugs; and on the present plan of practice, this vexatious circumstance is hardly to be avoided. The apothecaries shops, for the most part, are sup-

plied with ready-prepared medicines from the druggists, who have at length reduced it to a trade; and he who can supply his customers at the cheapest rate, is the most likely to establish an extensive business: This introduces the practice of sophistication, the greatest evil attendant on the practice of physic, and by which the ingenious practitioner is set on a level with the most ignorant empiric. It is far from being the writer's intention in what he here advances, to give offence to any man or body of men, but only to shew the disadvantage of applying medicines under the present mode of preparation.

P R E F A C E. v

ration. The mill, of which the following sheets contain the description, was invented with a view to supply these defects, and prevent these evils. A great expence of time and labour is hereby saved ; the inconvenience attending the lighter particles of the drugs flying off in the use of the pestle and mortar, is remedied by the density or close adhesion of the parts which form the barrel of the mill ; and every apothecary is enabled most easily and effectually to prepare his own medicines.

The author of this invention is well aware that it is still capable of
improve-

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improvement, and only exhibits it as the outlines of a work that may hereafter be brought to perfection, by those who are better skilled in mechanics than himself; but he humbly presumes that, even in it's present state, it will not be found inadequate to the purpose, or wholly unworthy the public notice: And the best excuse that can be offered for it's appearing so early in the world, is a maxim he has long imbibed, that whatever may have a shadow of becoming a public benefit, cannot too soon be made known. He has been for some time happy in the use of it himself, and in having it so well approved

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proved by his very ingenious and learned friend Dr. *Glynn*, of *Cambridge*.

The following pages are intended to give mechanical instructions for the formation of this little machine, and to throw such lights on the advantages attending it as may recommend it to a fair trial.



IN *Fig. I.* the Reader is presented with a view of the internal parts of the machine. The action of the wind drives round the sails *A*, together with their axle *AB*, and the wheel *C* which is fixed to the axle. The wheel *C* having (suppose) fourteen teeth, drives the toothed wheel *D*, which being fixed to the axle *DE*, turns round the barrel *F*, which is also fixed to the same axle.

axle. This barrel contains the ingredients that are to be pulverized, and performs the work of a pestle and mortar by a contrivance hereafter to be explained.

When any ingredients are to be put within the barrel, the wheel *D*, with it's axle and the barrel, are to be taken out of the mill. The barrel is then opened, by taking out it's moveable head *G H*, and the ingredients being placed within the barrel, together with some iron balls, are bruised and reduced to powder by the impulse of the balls, which are incessantly tossed about by the whirling of the barrel. To assist the action of these balls, four iron pegs (such as are represented by *Fig. II.*) must be fixed within the barrel after the following manner:

Having

Having drawn a circle within the barrel, about the middle, fasten therein the four iron pegs at the distance of a quarter of a circle from one another, so that their narrow ends (*Fig. II.*) may point towards each other from the opposite sides of the barrel. These pegs may be easily fixed by little screw-nuts *nn* (*Fig. I.*) on the outside of the barrel. The pegs being thus fixed, it is scarcely necessary to observe, that the balls rolling frequently against them will be driven with a considerable force against the ingredients within the barrel.

Presuming then, that the Reader has now gained some general idea of the principal contrivance of this machine, and it's manner of operation, it only remains that I should give a more minute description of the particular parts, and

afterwards subjoin some few hints about the construction and use of the whole.

When the wooden head *GH* of the barrel is taken out, the head *GH*, and the part *EK* (*Fig. I.*) of the axle are no longer fastened together, but are separate. The part *EK* is entirely of iron, and of such a shape as is exhibited in *Fig. III.* in which the four arms are supposed to cross one another at right angles. The four iron arms of *EK* being made to press against the head *GH* of the barrel, confine it in it's proper place, as may be conceived from *Fig. I.* This being understood, the method of causing the iron arms to press against the head of the barrel, so as to make (as it were) a part of it, and turn together with it, may be readily comprehended.

When

When the moveable head is thrust a little way into the barrel (where it may rest either against a shoulder cut within the sides of the barrel, or a collar of stiff leather fastened there for the purpose) the sides of the barrel will stand up about half an inch above the head, in the same manner as in a common beer-barrel. Within these sides let four notches be cut about a quarter of an inch deep, at the distance of a quarter of a circle from one another, for the reception of the four arms, which, by these means, will press flat against the head, and may be kept in that situation by the following contrivance.

Fig. IV. represents a thin plate of iron, (which I shall call an iron strap) having a square hole *q* at one end, and a round hole *r* at the other. The round hole *r* being put upon a hook
(suppose)

(suppose) at one end of the barrel, as in *Fig. I.* may be easily bent according to the form of the barrel, and made to lie in the situation *r q*; so that the square hole *q* may slip upon one of the ends of the four iron arms, and hold it tight. There must be four such iron straps, each laying hold of an iron arm, at the distance of a quarter of a circle from one another. The four iron arms must extend about half an inch beyond the notches in which they are placed, and in every arm a kind of notch *t* (*Fig. III.*) should be made, from which to the extremity, the iron should gradually slope; so that the square hole *q* of the strap being slipped over the slope into the notch, may there be detained after a manner not unlike to that of a latch within a catch upon a door: Indeed the hold of the iron strap may be further increased by screwing in the four
screws

screws *s* (*Fig. III.*) against the head of the barrel. Every screw works through an inside screw in each of the iron arms, so that when it is turned, the iron arm connected with it, is forced to recede a little from the head of the barrel, whereby the ends of the four iron arms press upwards against the straps hung on them with such a degree of force as may be necessary. It would not be amiss to fasten four ribs of wood to the head of the barrel, as in *Fig. V.* for they would at the same time receive the pressure of the screws *s* of *Fig. III.* and serve to strengthen the head of the barrel. Each screw *s* should be fastened by a string passing through a hole in it's handle (represented *Fig. III.*) and winding round, be tied, that the motion of the barrel may not loosen the screw from it's hold.

One thing may be further observed of the moveable head of the barrel, that it should be lined on it's inner side with thick buck leather, whereby it may be made to fit the barrel so closely, as even to hold mercury if necessary.

When I described the manner of fastening the four iron straps on the barrel, I observed that the round holes *r* (*Fig. I.*) might be made to pass upon a hook. Now four such iron arms as are fastened to the *moveable* head, may be screwed upon the *opposite* and *fixed* end of the barrel, the extremities of which arms projecting a little beyond the sides of the barrel, may be turned up, and answer the purpose of hooks to the straps, as in *Fig. VI.* This contrivance will serve both to strengthen the barrel, and to keep it steady in it's revolutions; for from the center of these
iron

iron arms, (which I suppose *fastened* to the fixed head of the barrel by any number of screws at pleasure) a thick iron bar may proceed, as in *Fig. VI.* which may become an axle to the wheel *D.* Thus the second axle in the mill (*Fig. I.*) and all its appurtenances become one strong and compact substance, not likely to be injured even in a high wind.

For the same purposes of strengthening the work, and to prevent a wabbling motion of the first axle which turns together with the sails, I have fixed a board (*Fig. VIII.*) without the mill, and fastened it by screws to the front plank at *xy* (*Fig. I.*) This board has a hole in the middle *o a*, through which the sail-axle passes. Such a contrivance will keep the sail-axle steady; for the parts of the board (*Fig. VII.*)

C

when

when shut, (as in *Fig. VIII.*) will close upon the neck of the axle by means of the hole *o a*, the diameter of which being about four inches, nearly equals that of the neck. The support of the mill may be made like that of any common windmill: As for instance, *L* is a strong post (*Fig. I.*) whereon the whole machine turns, which may also have two shoulders proceeding from it, for the better support of the weight to be sustained; *M* is a floor through which the post passes, and *N* is a second floor (ten inches above the former) which receives the end of the post, and confirms it's hold and support of the mill. The mill may be turned upon the post by a board *X*, five feet long, as in *Fig. IX.* which will also serve as a vane to keep the mill in the wind. In that figure the mill is represented as boarded on all sides, having a door *w* turning on

two

two hinges, which is to be opened as often as there may be occasion to take out the barrel and axle in the use of the mill.

As to the situation of the mill, any spot will serve that exposes the sails to the action of the wind. My own mill stands upon the top of an out-house, in the roof of which are two wooden doors, which being thrown open, and supported by chains, afford a convenient stage for a person to stand upon, who occasionally attends to the working of the machine. But that the Reader may form a more just notion of the whole design, it may not be amiss to add the materials and dimensions of the particular parts of the machine.

The wood which the artist should use in the construction of this machine

ought to be light and tough, such as
 abele or willow. If the two ends of
 the mill are constructed of plank two
 inches, or two inches and a half thick,
 the side boards may be nailed to them.

Let the length of the body be twen-
 ty-six inches, it's breadth eleven inches,
 and the height twenty-eight inches, ex-
 clusive of the roof.

Let each fail be three feet two inches
 in length from the axle to it's extremity,
 and let the width of each be sixteen
 inches.

The fail-axle should be made of good
 ash or oak, about four inches and a half
 square in that part where the mortices
 are made to admit the backs or pieces to
 which the fails are fastened. It should
 also be turned with a grove an inch
 wide,

wide, and a quarter of an inch deep about the neck. In the same axle, if you fasten an iron peg, and afterwards suspend a sort of iron strap, (like one of those mentioned above) from the roof by a staple, the hole in the strap may be made to lay hold of the iron peg occasionally, and easily stop the working of the mill. And here I must observe, that it is necessary to put a collar of iron round the axle-tree in the part where the peg is fixed, for otherwise a high wind might twist or even break the peg from it's hold.

The board, *Fig. VII. or VIII.* that serves to keep the axle-tree steady, must be an inch thick; and the two parts of this board may be easily kept together by wooden bolts and screws.

All

All the wheels should be made of knotty twisted elm; but if no wood of this kind can be procured, let the round wheel *first* be formed, and let the cogs be *afterwards* fixed in them. The former, however, is the easiest and cheapest method.

The wheel *C* (*Fig. I.*) on the fail-axle, should be about five inches and a half in diameter, exclusive of the teeth, the number of which may be determined by the judgment of the artist. This wheel (before the cutting of the teeth) must be turned a little beviling, by way of allowance for the inclined position of the fail-axle, as in *Fig. I.* by which means the teeth of this wheel will be made to fit exactly to the teeth of the wheel *D* underneath. The diameter of each of the wheels *C* and *D*, including the teeth, ought to be se-

ven

ven or seven inches and a half. The cask or barrel may contain about two gallons. Make it of dry rift oak, about half an inch thick, and bind it (like a common beer-barrel) with four iron hoops. Each hoop may be further secured by fixing a small screw on that side of it which is towards the narrow end of the barrel.

The iron spindles, (the one fixed and the other moveable) with their four arms at either end of the barrel, have been already described. I have only to add, that a knob *E*, at the end of the moveable spindle (*Fig. I.*) will be found very convenient; because if this knob be let into a cavity of the wood (or bone, or brass) it turns upon, it will want no other security.

Six or eight iron balls may be procured from Woolwich of any size, but those of six ounces will best be suited to a two gallon barrel. A barrel of this size will powder a pound and a half, or two pounds, at a time, of ipecacuanha, jal-lap, bark, and such like ; but a smaller quantity of light ingredients should be put in at once, such as flores chamæmeli, flores rosarium, &c. But before you powder such a medicine as rad. jallapii, I advise that it should be first cut with a cutting knife and block, whereby it may be the more easily and perfectly pulverized. All spherical or globular roots, must be cut before they are put into the mill ; and the ginger must also be cut, when you would make spec. aromat. Cut also, and that very thinly, in the pulvè tragacanth. comp. the rad. althææ, and glycyrrhizæ.

It is no small recommendation to this machine, that it not only prepares the medicines in a better manner, but in a much shorter time than any engine already in use. In general, it will perform it's work in twenty-four hours, with a good wind; though I have often suffered it to go for a whole week or longer; by which means it has reduced the contents of the barrel to a perfect alcohol. *Æthiops mineralis* in particular (*i. e.* argent. viv. flor. sulphur. ana lbij.) it will pound in four days much better, and with less loss than the same can be done with a pestle and mortar in as many months.

But let use and experience recommend the excellence of the machine, and the simplicity of it's invention; for although it has been my principal design to consult the advantage and convenience of

Apothecaries, I am not without hopes of it's being found useful hereafter in many other branches of business. Great improvements, no doubt, may be made by enlarging the scale, and by substituting a barrel of cast iron for one of wood; by which means it's use hereafter may be admitted among perfumers, colourmen, and such other artists as have occasion to pulverize the commodities belonging to their respective trades.

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